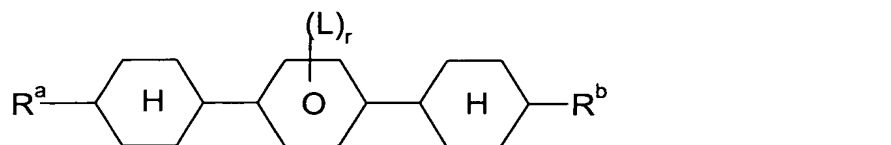


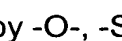
Patent Claims

1. A liquid-crystalline medium, comprising two or more liquid crystal compounds wherein at least one compound is of formula I



10 wherein

R^a is an alkenyl group having from 2 to 9 carbon atoms,

15 R^b is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF_3 or at least monosubstituted by halogen, and wherein one or more CH_2 groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-,

20 -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another,

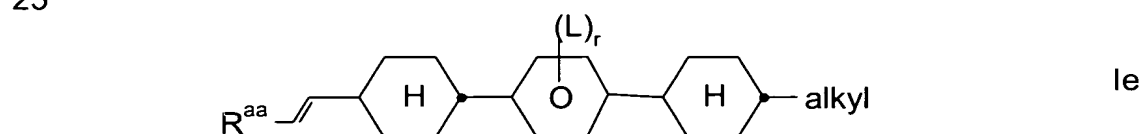
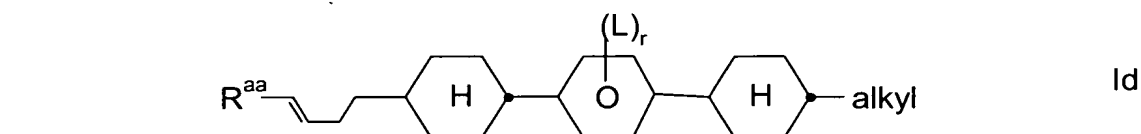
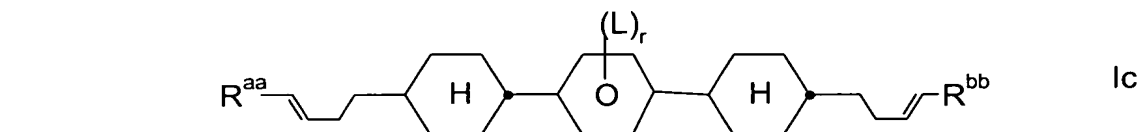
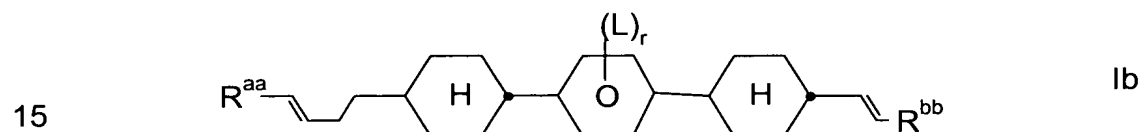
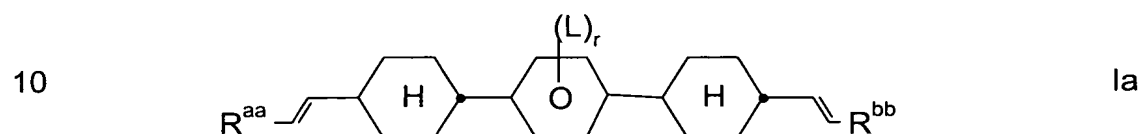
25 L is, in each occurrence independently, F, Cl, CN or an optionally mono- or polyhalogenated alkyl, alkoxy, alkenyl or alkenyloxy group having up to 3 carbon atoms, and

r is 0, 1, 2, 3 or 4.

- 30 2. A liquid-crystalline medium according to claim 1, wherein said medium comprises at least one compound of formula I in which the phenyl ring is substituted by L in 2- and 3-position or in 3- and 5-position or in 2- and 6-position, and/or R^b is alkenyl with 2 to 9 carbon atoms.

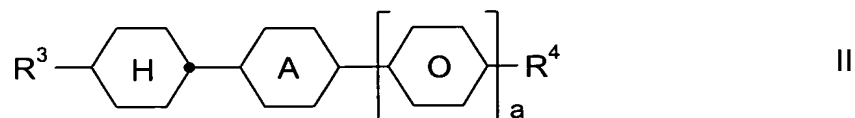
3. A liquid-crystalline medium according to claim 1 or 2, wherein said medium comprises at least one compound of formula I wherein L is F, Cl, CN, CF₃, OCF₃ or OCH₃.

5 4. A liquid-crystalline medium according to at least one of claims 1 to 3, wherein said medium comprises at least one compound of formula I selected from the following formulae



30 wherein R^{aa} and R^{bb} are independently of each other H, CH₃, C₂H₅ or n-C₃H₇ and alkyl is an alkyl group with 1 to 8 carbon atoms.

35 5. A liquid-crystalline medium according to at least one of claims 1 to 4, wherein said medium comprises at least one compound of formula II



5

in which

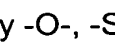
A is 1,4-phenylene or trans-1,4-cyclohexylene,

10

a is 0 or 1,

R³ is an alkenyl group having from 2 to 9 carbon atoms, and

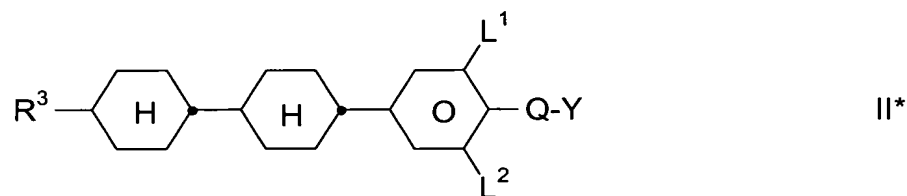
15

R⁴ is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF₃ or at least monosubstituted by halogen, and wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-, -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another.

20

6. A liquid-crystalline medium according to at least one of claims 1 to 5, wherein said medium comprises at least one compound of formula II*

25



30

wherein

R³ is an alkenyl group with 2 to 7 carbon atoms,

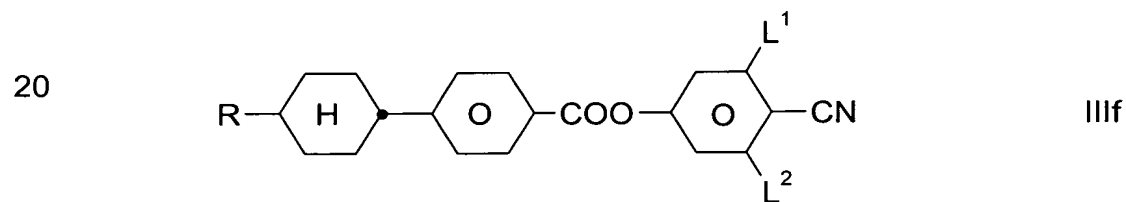
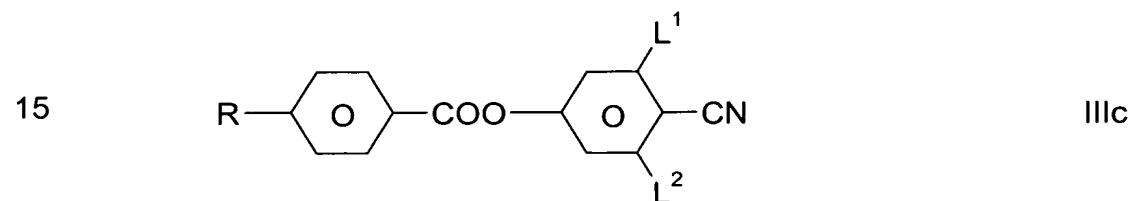
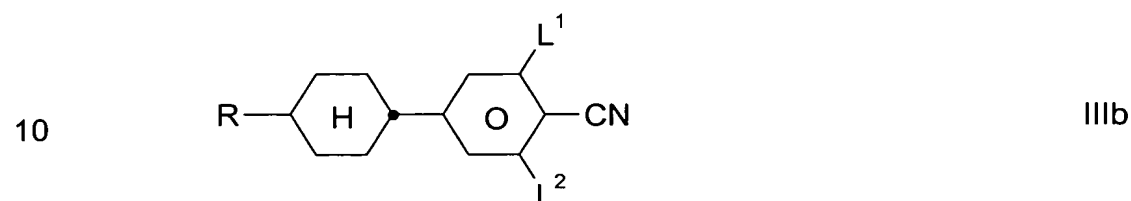
35

Q is CF₂, OCF₂, CFH, OCFH or a single bond,

Y is F or Cl, and

L^1 and L^2 are independently of each other H or F.

7. A liquid-crystalline medium according to at least one of claims 1 to 5,
 5 wherein said medium comprises at least one compound selected from the following formulae



25 wherein

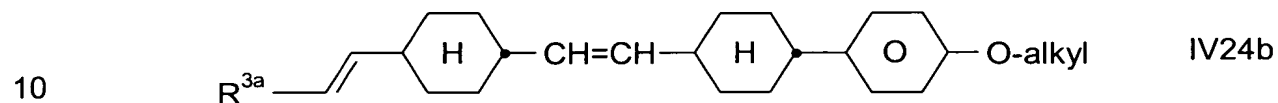
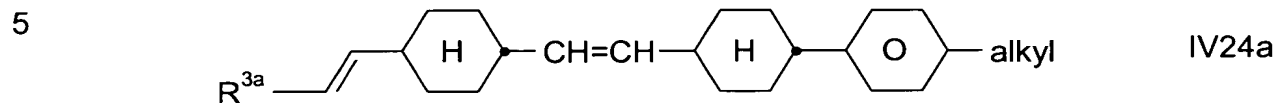
R is an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH_2 groups are each, independently of one another, optionally replaced by -O-, -CH=CH-, -CO-, -OCO- or -COO- in such a way that O atoms are not linked directly to one another, and

30

L^1 and L^2 are independently of each other H or F.

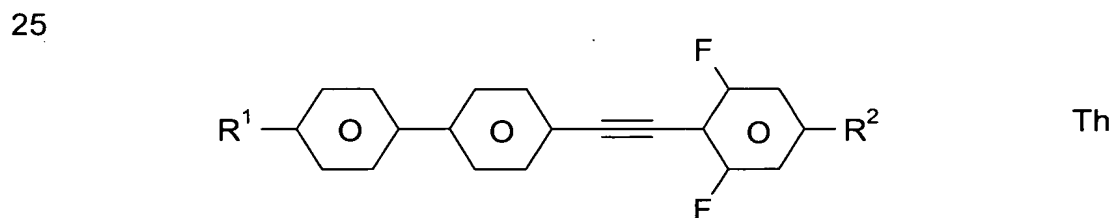
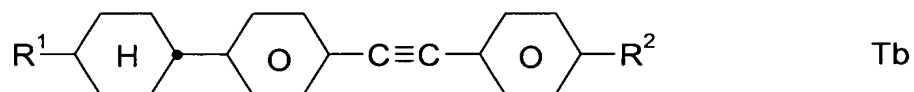
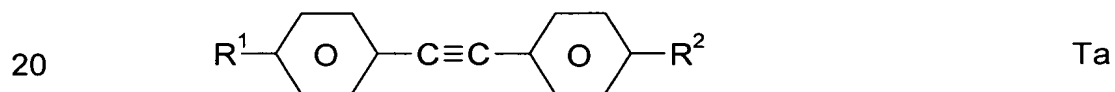
35

8. A liquid-crystalline medium according to at least one of claims 1 to 7, wherein said medium comprises at least one compound selected from the following formulae



wherein R^{3a} is H, CH_3 , C_2H_5 or $n-C_3H_7$ and alkyl is an alkyl group with 1 to 8 carbon atoms.

- 15 9. A liquid-crystalline medium according to at least one of claims 1 to 8, wherein said medium comprises at least one compound selected from the following formulae



30 wherein

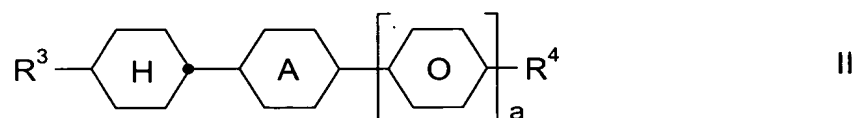
R^1 and R^2 are independently of each other an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH_2 groups are each, independently of one another, optionally replaced by $-O-$, $-CH=CH-$, $-CO-$, $-OCO-$ or $-$

COO- in such a way that O atoms are not linked directly to one another.

10. A liquid-crystalline medium according to at least one of claims 1 to 9,
5 wherein said medium comprises:

- one or more compounds of formula I;
- one or more compounds selected from formulae II,

10



15

in which

A is 1,4-phenylene or trans-1,4-cyclohexylene,

a is 0 or 1,

20

R³ is an alkenyl group having from 2 to 9 carbon atoms, and

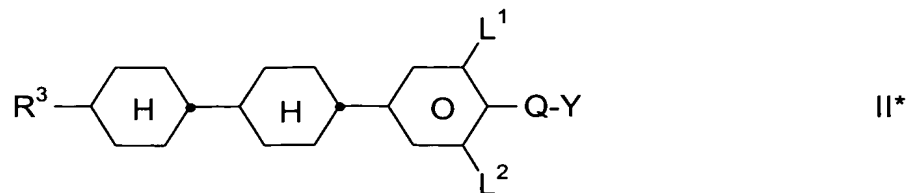
25

R⁴ is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF₃ or at least monosubstituted by halogen, and wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-, -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another;

30

- optionally one or more compounds of formula II*,

35



wherein

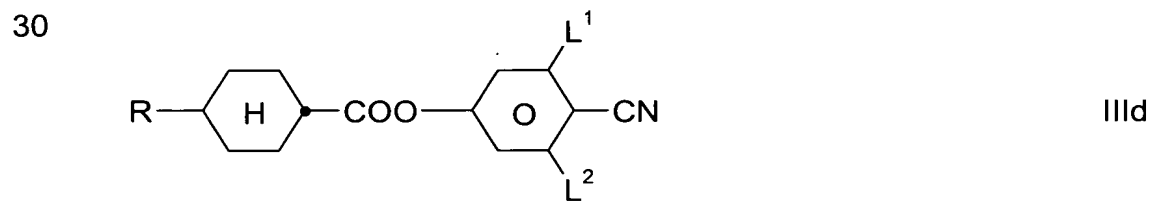
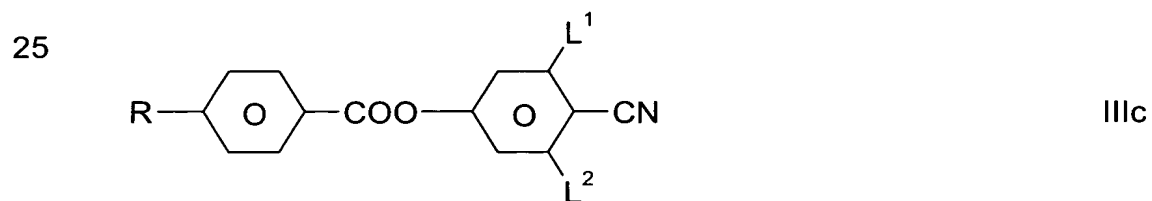
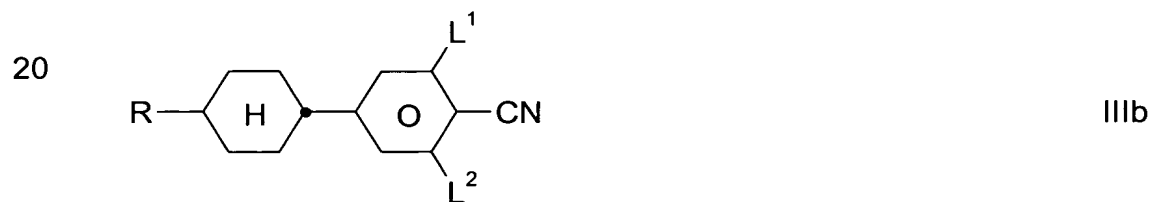
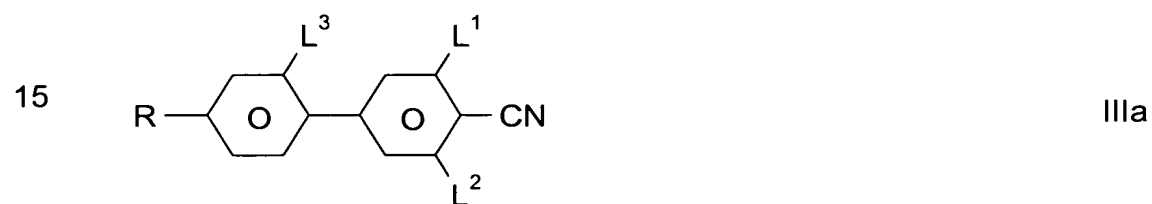
R^3 is an alkenyl group with 2 to 7 carbon atoms,

Q is CF_2 , OCF_2 , CFH, OCFH or a single bond,

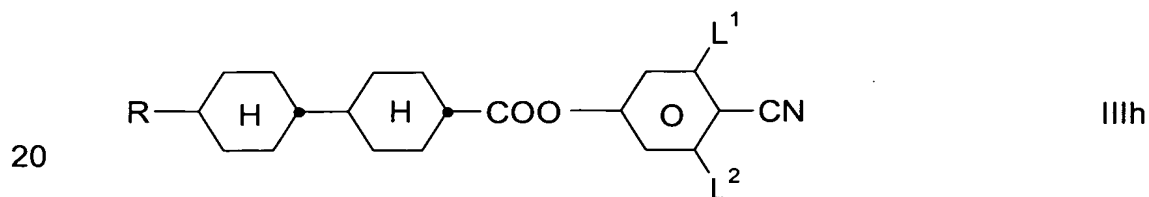
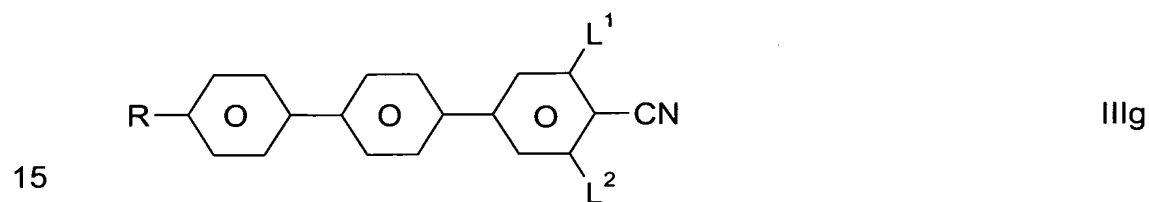
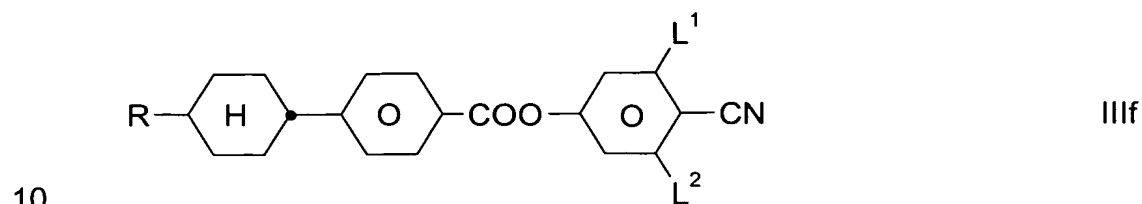
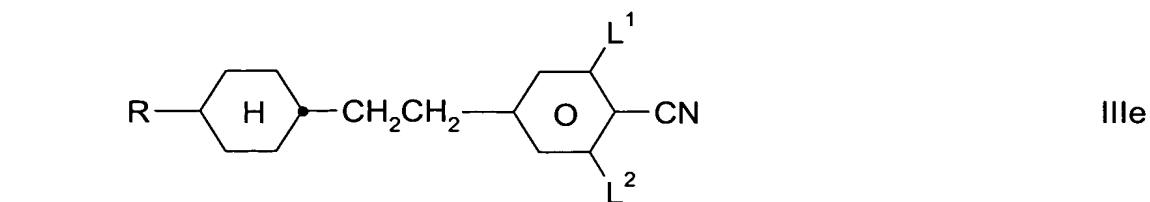
Y is F or Cl, and

L^1 and L^2 are independently of each other H or F;

- one or more compounds selected from formulae IIIa-IIIh,



35

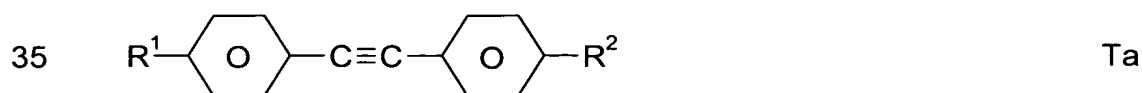


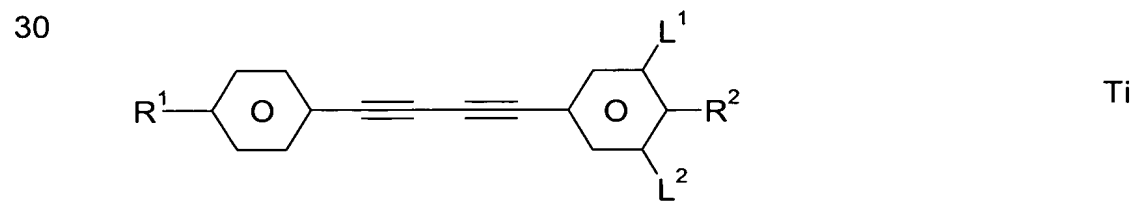
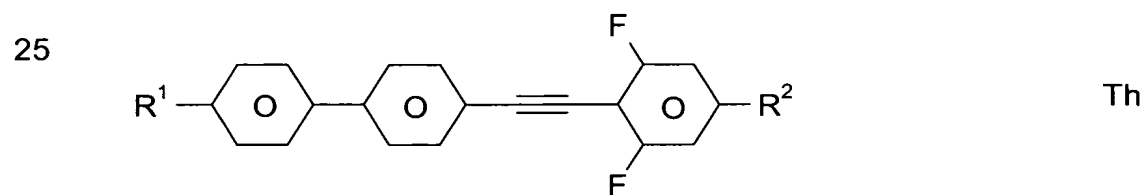
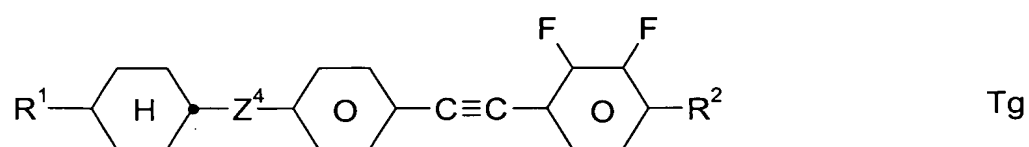
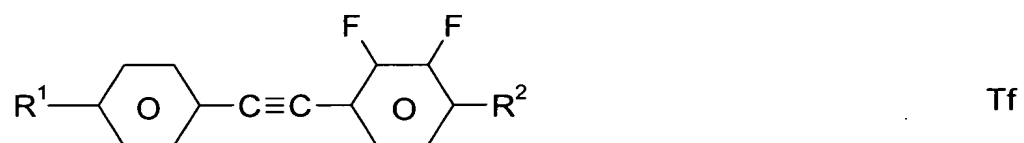
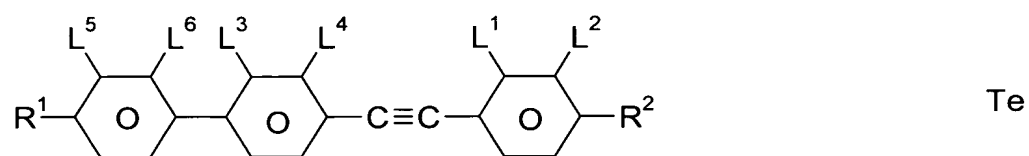
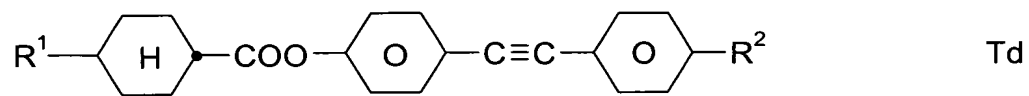
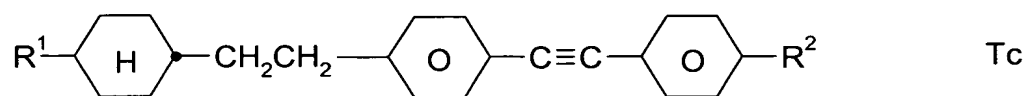
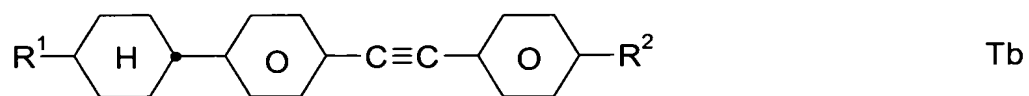
wherein

25 R is an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -CH=CH-, -CO-, -OCO- or -COO- in such a way that O atoms are not linked directly to one another, and

30 L¹, L² and L³ are independently of each other H or F;

- one or more compounds selected of formulae Ta-Ti,



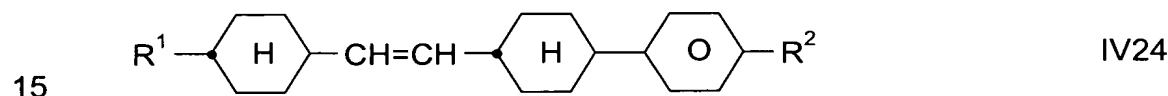


wherein

5 R^1 and R^2 are independently of each other an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH_2 groups are each, independently of one another, optionally replaced by $-O-$, $-CH=CH-$, $-CO-$, $-OCO-$ or $-COO-$ in such a way that O atoms are not linked directly to one another,

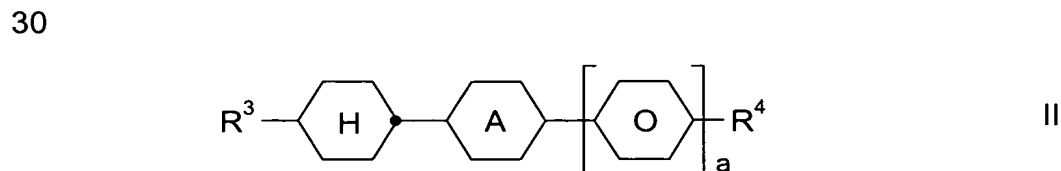
10 Z^4 is $-CO-O-$, $-CH_2CH_2-$ or a single bond, and
 10 L^1 to L^6 are independently of each other H or F; and

- optionally one or more compounds of formula IV24



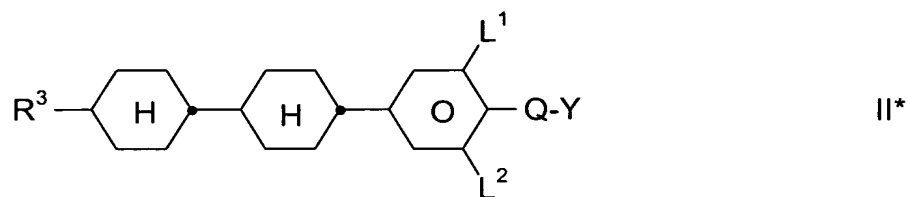
wherein
 20 R^1 and R^2 are independently of each other an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms; wherein one or more CH_2 groups are each, independently of one another, optionally replaced by $-O-$, $-CH=CH-$, $-CO-$, $-OCO-$ or $-COO-$ in such a way that O atoms are not linked directly to one another.

25 11. A liquid-crystalline medium according to at least one of claims 1 to 10, wherein said medium comprises
 - 5 to 30 % of compounds of formula I;
 - 10 to 50 % of compounds selected from formula II and II*,



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- 58 -



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in which

A is 1,4-phenylene or trans-1,4-cyclohexylene,

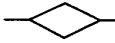
10

a is 0 or 1,

R³ in formula II is an alkenyl group having from 2 to 9 carbon atoms,

15

R³ in formula II* is an alkenyl group with 2 to 7 carbon atoms,

R⁴ is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF₃ or at least monosubstituted by halogen, and wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-, -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another,

20

25

Q is CF₂, OCF₂, CFH, OCFH or a single bond,

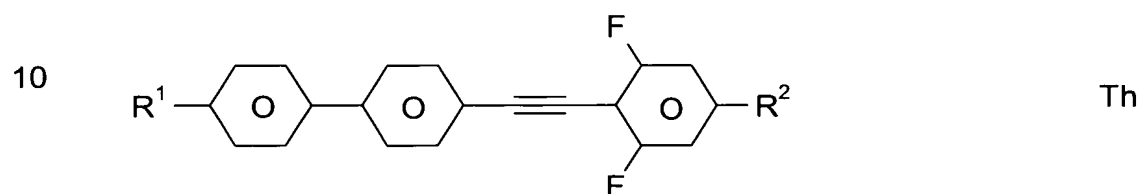
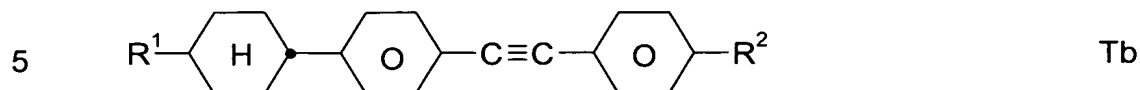
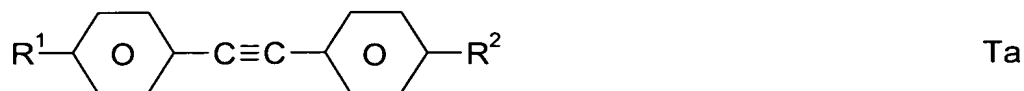
Y is F or Cl, and

30

L¹ and L² are independently of each other H or F;

- 7 to 45 % of compounds selected formula Ta, Tb and Th,

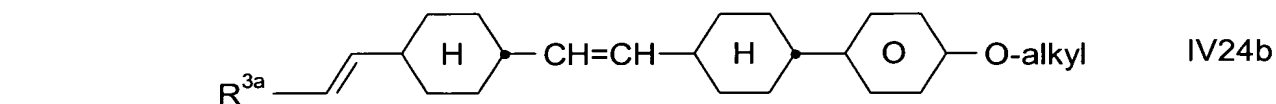
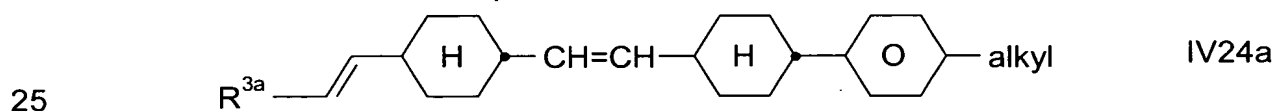
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wherein

15 R^1 and R^2 are independently of each other an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH_2 groups are each, independently of one another, optionally replaced by $-O-$, $-CH=CH-$, $-CO-$, $-OCO-$ or $-COO-$ in such a way that O atoms are not linked directly to one another;

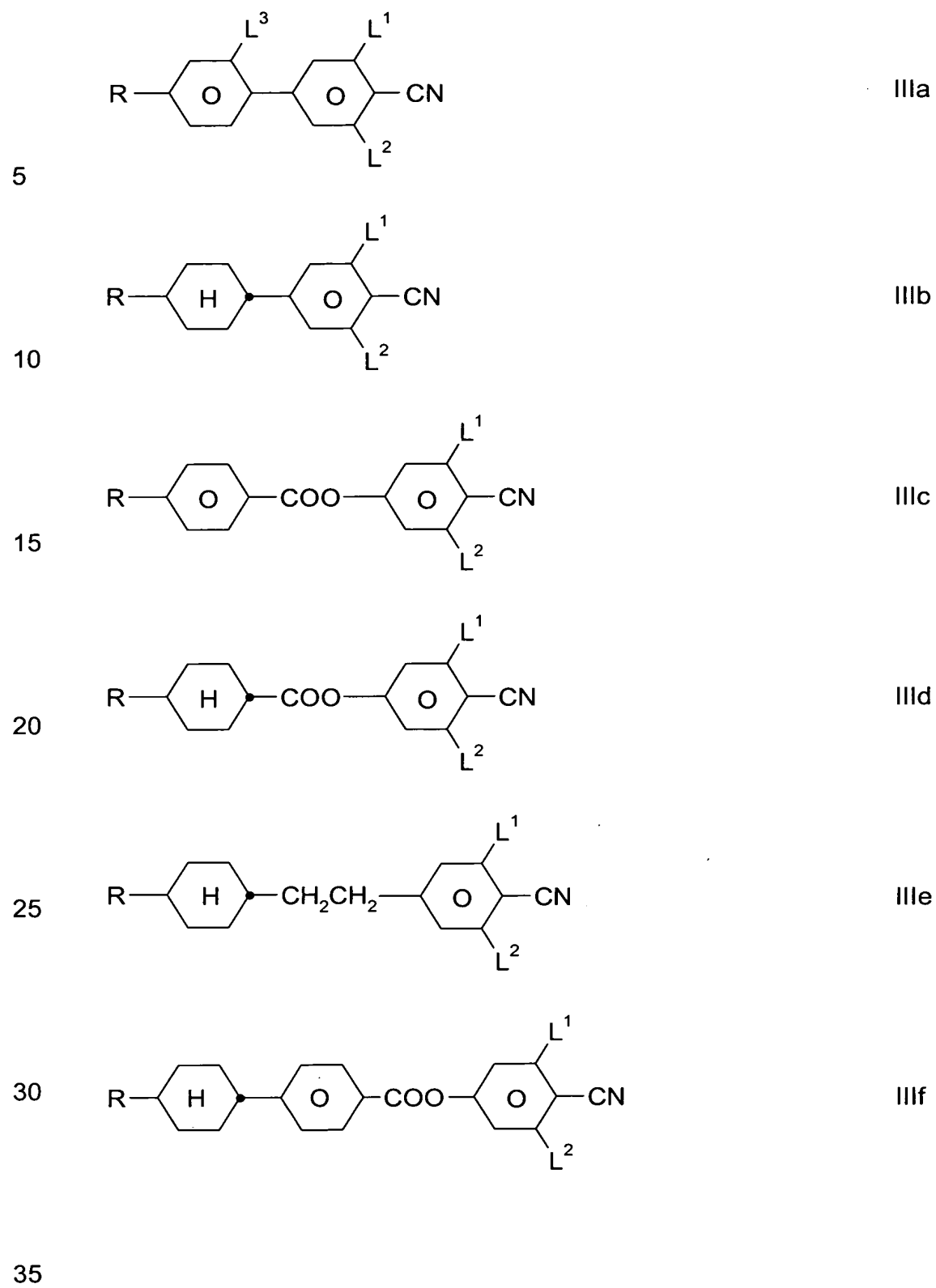
- 2 to 25 % of compounds selected from formula IV24a and IV24b,

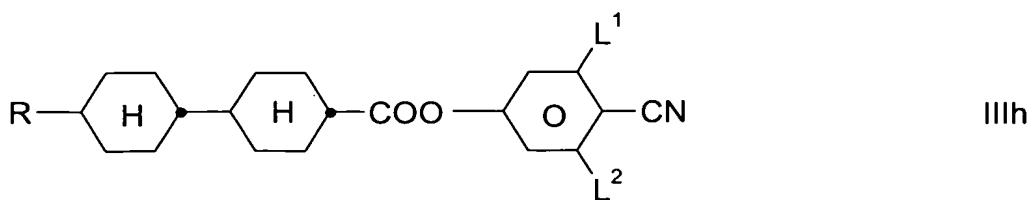
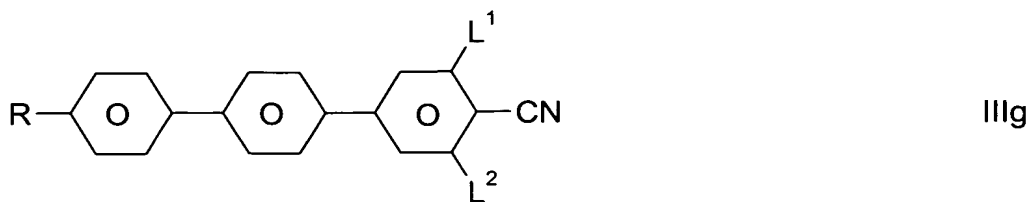


30 wherein R^{3a} is H, CH_3 , C_2H_5 or $n-C_3H_7$ and alkyl is an alkyl group with 1 to 8 carbon atoms;and

- 8 to 40 % of compounds selected from formulae IIIa to IIIh

35





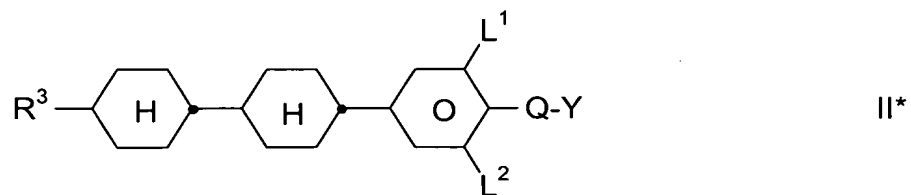
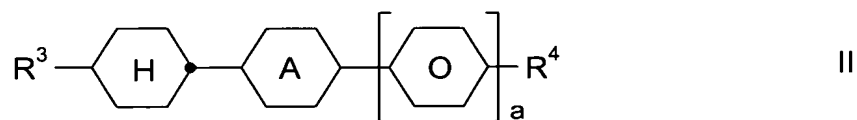
wherein

15 R is an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -CH=CH-, -CO-, -OCO- or -COO- in such a way that O atoms are not linked directly to one another, and

20 L¹, L² and L³ are independently of each other H or F.

12. A liquid-crystalline medium according to at least one of claims 1 to 10, wherein said medium comprises

- 25
- 6 to 20 % of compounds of formula I;
 - 10 to 40 % of compounds selected from formula II and II*,



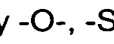
in which

A is 1,4-phenylene or trans-1,4-cyclohexylene,

5 a is 0 or 1,

R³ in formula II is an alkenyl group having from 2 to 9 carbon atoms,

10 R³ in formula II* is an alkenyl group with 2 to 7 carbon atoms,

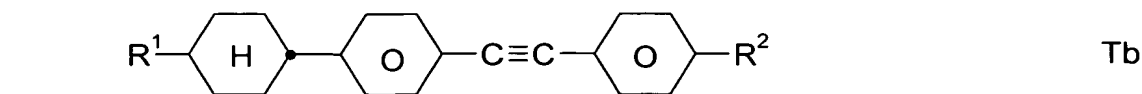
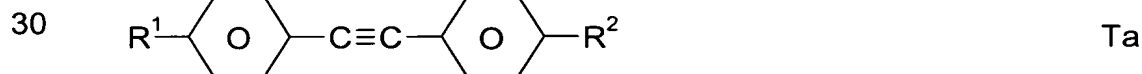
R⁴ is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF₃ or at least monosubstituted by halogen, and wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-, -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another,

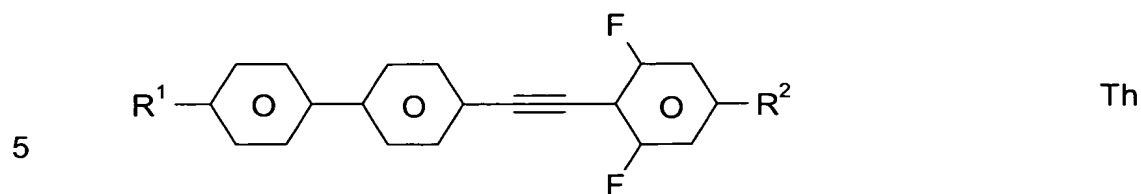
20 Q is CF₂, OCF₂, CFH, OCFH or a single bond,

Y is F or Cl, and

25 L¹ and L² are independently of each other H or F;

- 10 to 30 % of compounds selected formula Ta, Tb and Th,

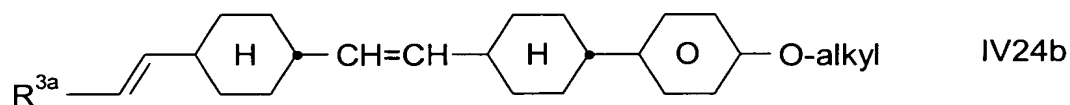
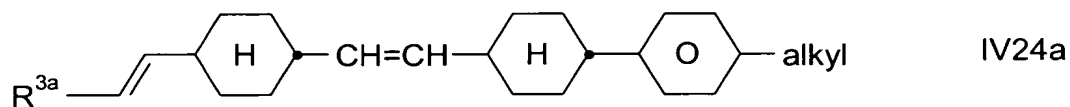




wherein

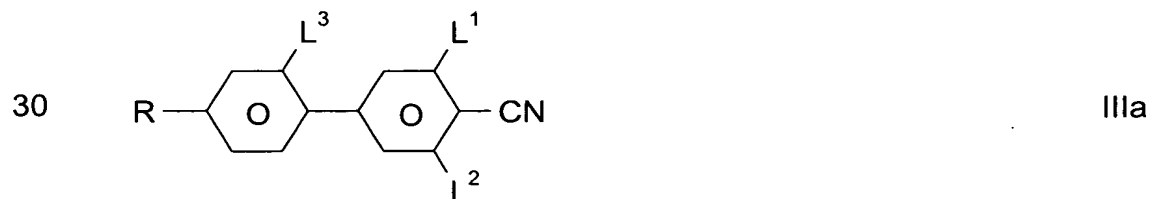
10 R^1 and R^2 are independently of each other an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH_2 groups are each, independently of one another, optionally replaced by -O-, -CH=CH-, -CO-, -OCO- or -COO- in such a way that O atoms are not linked directly to one another;

15 - 3 to 20 % of compounds selected from formula IV24a and IV24b,

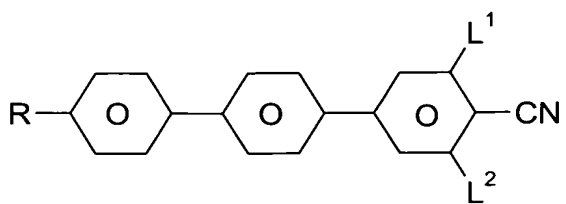
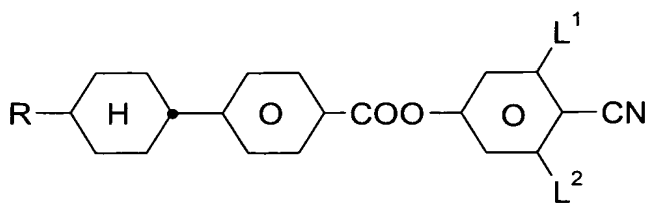
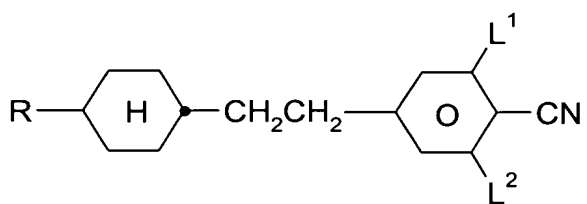
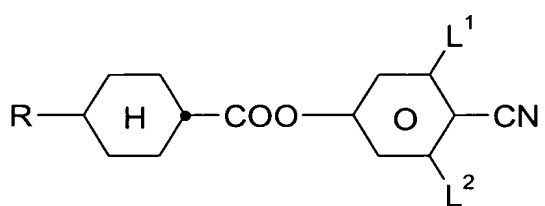
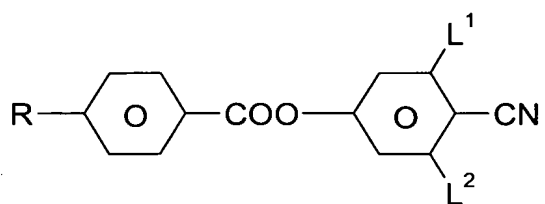
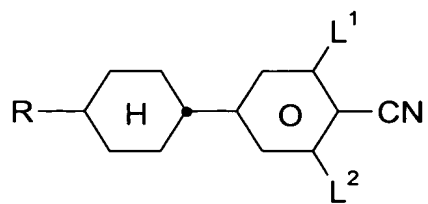


25 wherein R^{3a} is H, CH_3 , C_2H_5 or $n-C_3H_7$ and alkyl is an alkyl group with 1 to 8 carbon atoms; and

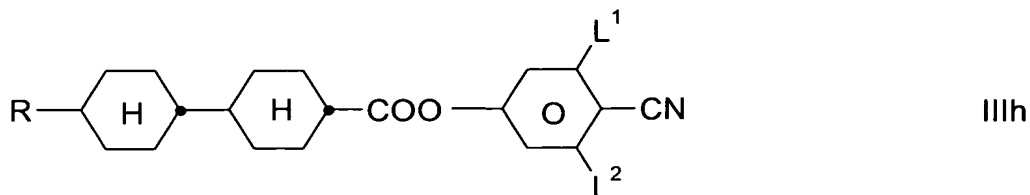
- 10 to 30 % of compounds selected from formulae IIIa to IIIh



35



- 65 -



5

wherein

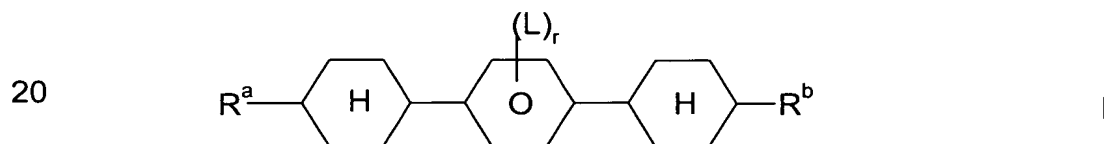
R is an alkyl, alkoxy or alkenyl group having from 1 to 12 carbon atoms, wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -CH=CH-, -CO-, -OCO- or -COO- in such a way that O atoms are not linked directly to one another, and

10

L¹, L² and L³ are independently of each other H or F.

15

13. A liquid-crystalline compound of formula I



20

wherein

R^a is an alkenyl group having from 2 to 9 carbon atoms,

25

R^b is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF₃ or at least monosubstituted by halogen, and wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-, -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another,

30

35

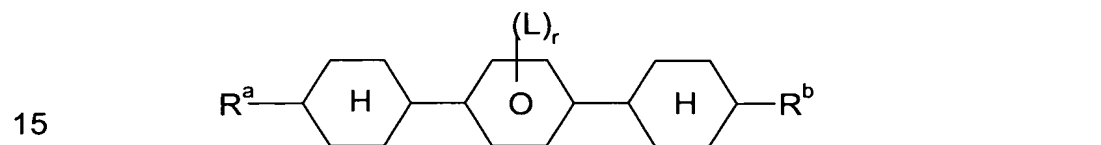
L is, in each occurrence independently, F, Cl, CN or a mono- or polyhalogenated alkyl, alkoxy, alkenyl or alkenyloxy group having up to 3 carbon atoms, and

5 r is 0, 1, 2, 3 or 4,

wherein the phenyl ring is substituted by L in 2- and 3-position or in 3- and 5-position or in 2- and 6-position, and/or R^b is alkenyl with 2 to 9 carbon atoms.


10

14. A liquid-crystalline compound of formula I



wherein

20 R^a is an alkenyl group having from 2 to 9 carbon atoms,

R^b is an alkyl group having 1 to 12 carbon atoms which is unsubstituted, monosubstituted by CN or CF₃ or at least monosubstituted by halogen, and wherein one or more CH₂ groups are each, independently of one another, optionally replaced by -O-, -S-, , -CH=CH-, -C≡C-, -CO-, -CO-O-, -O-CO- or -O-CO-O- in such a way that O atoms are not linked directly to one another,

25

30 L is F, Cl, CN, CF₃, OCF₃ or OCH₃, and

r is 0, 1, 2, 3 or 4,

15. An electro-optical liquid-crystal display containing a liquid-crystalline medium according to at least one of claims 1 to 12.

35

16. An electro-optical liquid-crystal display containing a liquid-crystalline compound according to at least one of claims 13 to 14.

17. A TN or STN liquid-crystal display comprising:

5

– two outer plates, which, together with a frame, form a cell,

– a nematic liquid-crystal mixture of positive dielectric anisotropy located in the cell,

10

– electrode layers with alignment layers on the insides of the outer plates,

– a tilt angle between the longitudinal axis of the molecules at the surface of the outer plates and the outer plates of 0 to 30 degrees, and

15

– a twist angle of the liquid-crystal mixture in the cell from alignment layer to alignment layer with a value of 22.5° - 600° , and

– a nematic liquid-crystal mixture comprising

20

a) 15 – 75% by weight of a liquid-crystalline component A consisting of one or more compounds having a dielectric anisotropy of greater than +1.5;

25

b) 25 – 85% by weight of a liquid-crystalline component B consisting of one or more compounds having a dielectric anisotropy of between -1.5 and +1.5;

c) 0 – 20% by weight of a liquid-crystalline component D consisting of one or more compounds having a dielectric anisotropy of below -1.5, and

30

d) if desired, an optically active component C in such an amount that the ratio between the layer thickness and the natural pitch of the chiral nematic liquid-crystal mixture is from about 0.2 to 1.3,

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wherein said nematic liquid-crystal mixture is as defined in at least one of claims 1 to 12.